

CS 575/475

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## Project #2 Functional Decomposition

1. What your own-choice quantity was and how it fits into the simulation.

I introduce the number of predators as a self-selected quantity. If the number of predators is higher than a certain threshold (let's say 3), the number of deer will decrease (-1); if the number of predators is lower, the number of deer may Increase (+1). As you can see from the graph, there is a clear correlation between changes in predator abundance (gray line) and deer abundance (orange line). When predator numbers rise at one point in time, we soon see deer numbers decline, reflecting the predator pressure on the herd.

At the same time, the results of this predation indirectly affect the grain height (blue line), because the number of deer is reduced, the consumption of grain is also reduced, so that the grain can grow better. At different stages of the graph, this relationship manifests itself as peaks in grain height tending to occur after troughs in deer numbers.

In nature, there are complex interrelationships between predators, herbivores, and plants: predators control herbivore populations by preying on them, and herbivores, in turn, influence plant growth by consuming them. In this simulation, the presence of predators affects deer abundance and, indirectly, grain height, since deer abundance is directly related to grain consumption. By introducing the variable of predators, the simulation is closer to the real ecosystem dynamics, and it is possible to observe the impact on the entire simulated system when the number of predators changes.

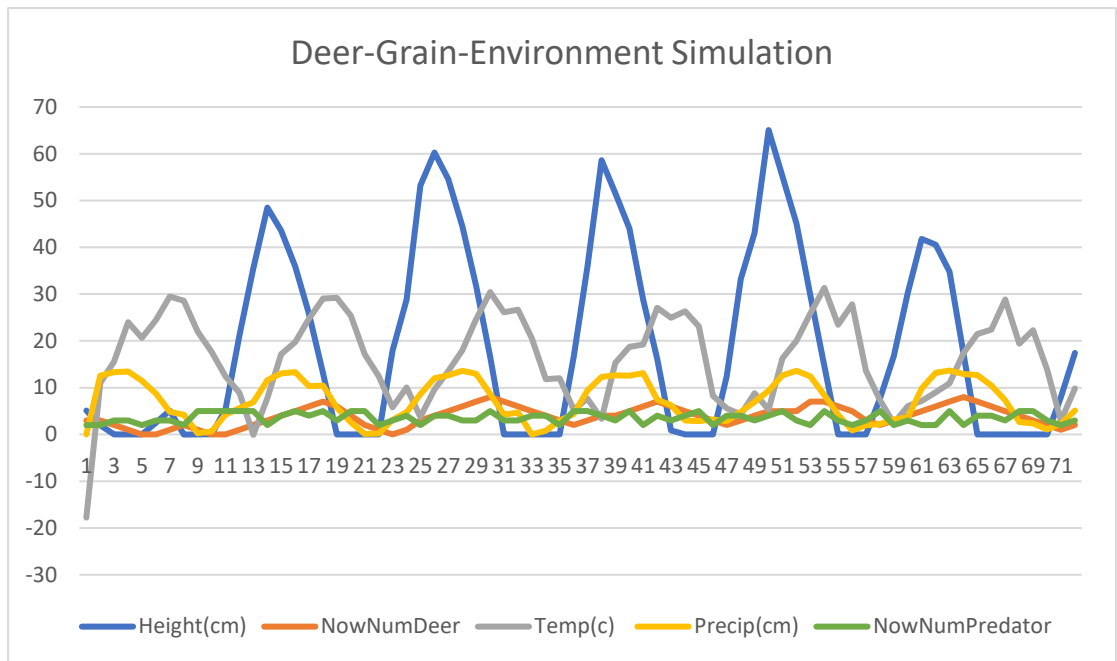
2. A table showing values for temperature, precipitation, number of deer, height of the grain, and your own-choice quantity as a function of month number.

Month	Height(cm)	NowNumDeer	Temp(c)	Precipitation (cm)	NowNumPredator
1	5.080001	3	-17.7778	0	2
2	1.925103	3	11.02681	12.581077	2
3	0	2	15.60693	13.333856	3
4	0	1	23.9843	13.484087	3
5	0	0	20.6456	11.478701	2

6	2.540069	0	24.45934	8.728119	3
7	5.080069	1	29.45862	4.846762	3
8	0.000069	2	28.57097	4.193511	2
9	0	1	22.01226	0.223724	5
10	0.044409	0	17.66076	0.661685	5
11	5.293053	0	12.46419	4.196763	5
12	21.23337	1	8.856547	5.628813	5
1	35.49577	2	-0.07338	6.867329	5
2	48.47612	3	7.800314	11.639468	2
3	43.54311	4	17.16168	13.073317	4
4	35.9369	5	19.75078	13.315561	5
5	25.77695	6	24.76101	10.313905	4
6	13.07695	7	29.04327	10.416539	5
7	0	6	29.21672	5.690722	3
8	0	4	25.39658	2.540642	5
9	0	2	17.14385	0.107938	5
10	0	1	12.46155	0.213408	2
11	17.9335	0	5.803443	3.140252	3
12	28.8452	1	10.05642	4.786539	4
1	53.19959	3	3.754489	8.604177	2
2	60.26937	4	9.656995	11.985676	4
3	54.62001	5	13.51807	12.668402	4
4	44.52994	6	17.99577	13.570745	3
5	31.82999	7	24.6127	12.962366	3
6	16.58999	8	30.40969	8.676505	5
7	0	7	26.14683	4.223559	3
8	0	6	26.68519	4.70994	3
9	0	5	20.58216	0	4
10	0	4	11.80742	0.784399	4
11	0	3	12.01375	2.965959	2
12	16.63842	2	5.284833	4.37837	5
1	35.9014	3	7.644352	9.428385	5
2	58.59825	4	3.3208	12.279479	4
3	51.60267	4	15.30003	12.643221	3
4	44.02089	5	18.73325	12.577316	5
5	28.80509	6	19.18736	13.098278	2
6	16.1051	7	27.05263	7.465446	4
7	0.865126	6	24.96846	6.289004	3
8	0	5	26.29832	3.019467	4
9	0	4	23.09406	2.841019	5
10	0	3	8.264912	3.178337	2

11	12.44973	2	5.554983	2.836107	4
12	33.20707	3	4.315879	4.821237	4
1	43.1036	4	8.809361	6.945724	3
2	65.0731	5	5.326125	9.331828	4
3	55.2162	5	16.28415	12.626416	5
4	45.06624	5	20.05018	13.576838	3
5	29.82625	7	25.82072	12.401114	2
6	14.58625	7	31.33093	8.390654	5
7	0	6	23.45355	4.232222	3
8	0	5	27.85393	0.892187	2
9	0	3	13.61562	1.987542	3
10	7.708758	2	7.288026	2.212065	5
11	16.70918	3	2.343947	3.192013	2
12	30.39557	4	6.074217	3.6838	3
1	41.79178	5	7.135631	9.810331	2
2	40.57556	6	9.004152	13.204524	2
3	34.79895	7	10.89502	13.660673	5
4	17.13589	8	17.44893	12.894579	2
5	0	7	21.43784	12.683045	4
6	0	6	22.43236	10.428211	4
7	0	5	28.82358	7.328104	3
8	0	4	19.41779	2.62843	5
9	0	3	22.27765	2.339285	5
10	0	2	13.85627	1.065502	3
11	8.007181	1	2.901497	2.312837	2
12	17.42687	2	9.813656	5.098698	3

3. A graph showing temperature, precipitation, number of deer, height of the grain, and your own-choice quantity as a function of month number.



4. A commentary about the patterns in the graph and why they turned out that way. What evidence in the curves proves that your own quantity is actually affecting the simulation correctly?

The height of grains (Height) shows a climate change pattern related to temperature (Temp) and precipitation (Precip), reflecting the impact of these two environmental factors on grain growth. The number of deer (NowNumDeer) is highly related to grain, because grain is the food source of deer. Deer numbers increase during months when grain is growing well; when grain height decreases, deer numbers may be declining due to food shortages. Additionally, the deer population should show a direct response to fluctuations in predator abundance due to predation on the deer population by a predator (NowNumPredator). The monthly predator numbers are random, and it can be clearly seen that there is a clear staggered number of deer and predators. During periods of higher predator abundance, we can expect deer populations to decline, and when predator numbers decrease, deer herds have a chance to recover.